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(54) Electromagnetic chain gun

(57) An electromagnetic gun comprising parallel conducting electrodes is used to fire a continuous rubber chain. On firing, links leaving the barrel will have higher velocity than those already ejected and so the chain will tend to become coiled in flight covering a volume in flight which relaxes the firing accuracy requirement for hitting incoming projectiles aimed at ships for example. The chain 40 comprises a series of links 20 with conducting armatures 21 provided at intervals less than the length of the gun barrel 45 for current conduction. A magazine arrangement 41-44 may be provided which feeds the chain to the barrel so as to lessen the impedance to acceleration of the chain on firing. Flying cutters 46 may be provided to cut predetermined lengths of chain for firing.

Fig. 2.

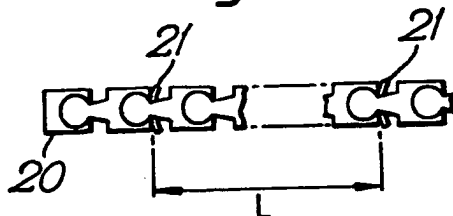
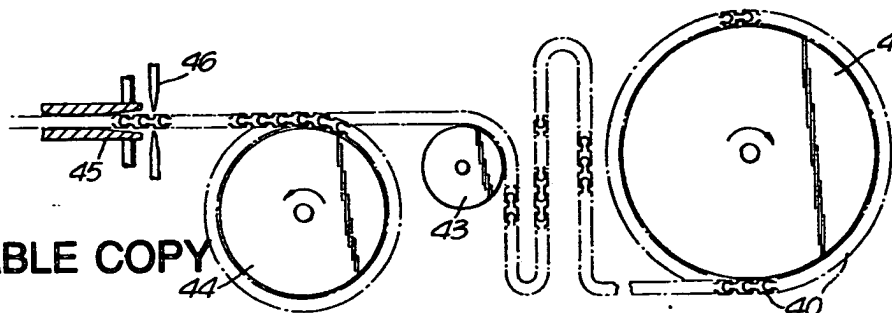


Fig. 4.



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Fig. 1.

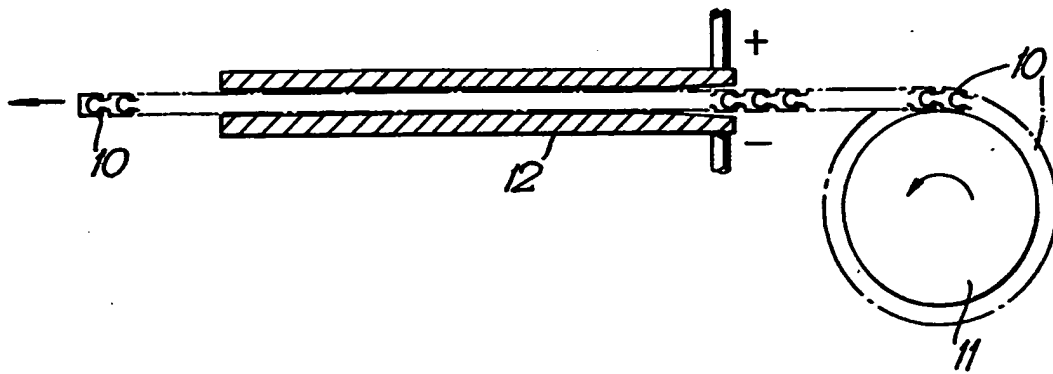


Fig. 2.

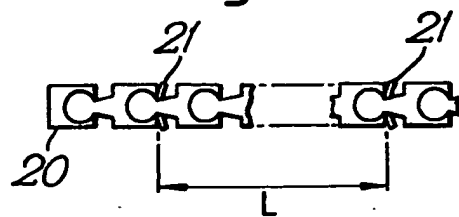
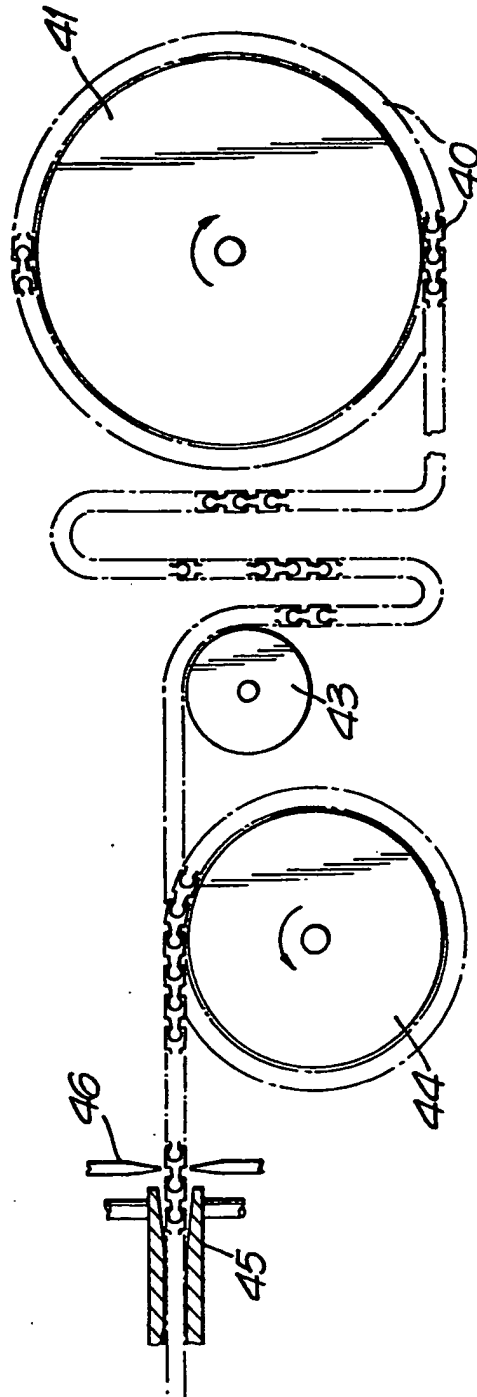


Fig. 3.



Fig. 4.



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Electromagnetic Chain Gun

The invention relates to devices generally termed eletromagnetic launchers employing parallel conductors carrying electric currents for accelerating projectiles between the conductors.

Known applications of electromagnetic guns cover the launching of discrete projectiles. Such discrete launching of non-guided projectiles does not provide an ideal solution for a defensive weapon intended of hit fast incoming projectiles.

The object of the present invention is to provide means to launch a defensive projectile to provide a large area defensive screen with a consequential high probability of intercepting an incoming projectile.

The invention provides an electromagnetic gun comprising parallel conducting electrodes used to fire a continuous flexible (e.g. rubber) chain. On firing, links leaving the barrel will have higher velocity than those already ejected and so the chain will tend to become coiled in flight covering a volume in flight which relaxes the firing accuracy requirement for hitting incoming projectiles aimed at ships for example.

The chain comprises a series of links with conducting armatures provided at intervals less than the length of the barrel for current conduction.

A magazine arrangement may be provided which feeds the chain to the barrel so as to lessen the impedance to acceleration of the chain on firing.

Flying cutters may be provided to cut predetermined lengths of chain for firing.

The invention will now be described by way of example

only with reference to the accompanying Drawings of which:
Figure 1 is a lateral cross through an electromagnetic gun, with chain loading mechanism according to the invention;
Figure 2 is a detailed section through a number of links of the chain projectile;
Figure 3 is a schematic view of the Figure 1 gun being fired towards a target missile; and
Figure 4 is a diagrammatic view of a chain feed mechanism for the gun.

This invention makes use of electromagnetic launch and railgun technology currently under investigation for defence applications. The device described herein is, however, unlike other known types of electromagnetic launcher inasmuch as it does not fire discrete projectiles. It propels a continuous chain rubber 10, coiled on a drum 11, from an electromagnetic rail gun 12 as shown in Figure 1.

Possible applications include self defense for ships and fighting vehicle and the device is possibly relevant to the SDI programme.

It is envisaged that the chain would consist of linked elements 20 akin to the arrangement shown in Figure 2. Armature plates 21 would need to be fitted in order to complete a low resistance electrical circuit through the rails and across the chain and as shown these are fitted at intervals L slightly less than the gun barrel length. Alternatively, such plates might be fitted behind each link of the chain. The links could be either round or square in section depending upon the internal configuration of the gun.

The part 30 of the chain that is sandwiched between the rails is accelerated as a result of the current and flux density existing at the armature positions. Due to this acceleration, links 31 which have been ejected from the gun barrel will be travelling at a lower speed than those 30 still within the barrel and it is thus envisaged that lateral dispersion of the chain

will occur as it proceeds towards its target 32. This effect, resulting from recently ejected links trying to 'overtake' those in front.

Such dispersion is beneficial inasmuch as it relaxes the requirement for gun pointing accuracy. The chain covers a volume of space that is much greater than that which can be achieved with discrete projectiles.

The operation of the gun is dependent upon a suitable design of chain feed system. In the simple arrangement shown in Figure 1, the electromagnetic force must not only accelerate the part of the chain which lies within the barrel, but must also overcome the moment of inertia of the drum 11 and chain coils 10. This will influence the ejection velocity and its variation with time. A 'trade off' therefore exists between the total length of chain to be fired and the kinetic energy levels achievable by individual links.

A more sophisticated magazine arrangement would be possible whereby a 'ready use' drum is used for individual firings fed from a main supply drum as shown in Figure 4. The chain 40 is coiled around a supply drum 41. A portion 42 of slack chain is provided between the drum 41 and a guiding wheel 43. A 'ready use' drum 44 is disposed between the gun 45 and the guiding wheel 43. The chain is coiled around the 'ready use' drum 44 in the opposite sense to the coils around the supply drum 41. Flying shears 46 are provided; their use being synchronised to the firing of the gun so as to cut predetermined lengths of chain for firing. The supply drum 41 could be motor driven to an appropriate speed prior to energisation of the gun. The launched portion of chain is then cut to a desired length using the flying shear arrangement or alternately by a mechanical brake giving sufficient deceleration to cause mechanical failure between links.

Claims

1. An electromagnetic gun arrangement comprising:
a barrel formed by parallel conducting electrodes; and
a continuous chain of flexible material, at least in part
conducting, such that the chain can be propelled along the length
of the barrel when a suitable electric field is provided
therebetween.
2. An electromagnetic gun arrangement as claimed in claim 1
wherein the flexible material is rubber.
3. An electromagnetic gun arrangement as claimed in claim 1 or 2
wherein the chain comprises a series of links with conducting
armatures provided at intervals less than the length of the
barrel for current conduction.
4. An electromagnetic gun arrangement as claimed in any one
preceding claim wherein a magazine arrangement is provided to
feed the chain to the barrel so as to lessen the impedance to
acceleration of the chain on firing.
5. An electromagnetic gun arrangement as claimed in claim 4
wherein flying cutters are provided to cut predetermined lengths
of chain for firing.
6. An electromagnetic gun arrangement substantially as
described with reference to the accompanying Drawings.

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